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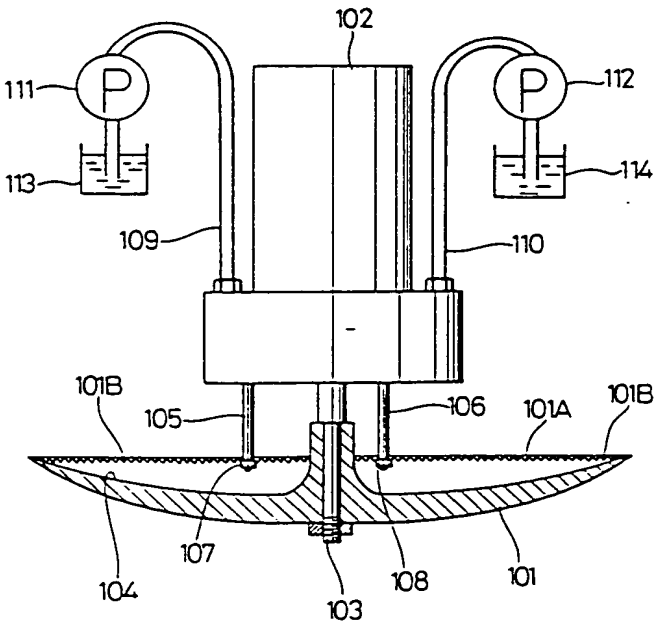
(54) **Rotary liquid sprayer.**

(57) A rotary liquid sprayer comprises a rotary atomizing head (101) provided with a liquid contact surface (104) onto which one or more liquids to be sprayed can be delivered from at least one liquid spout nozzle (107,108), the liquid being discharged thereby in a diverging pattern of a predetermined shape in plan view. A high voltage may be applied to the rotary head (101) if desired.



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Rotary Liquid Sprayer

A rotary liquid sprayer which essentially includes: a rotary atomizing head having a liquid contact surface for receiving thereon a liquid to be atomized; a rotational shaft for rotating the atomizing head at a high speed; and at least one spout nozzle for spurting under pressure the atomizing liquid in a pattern of a predetermined shape in plan view and spreading toward the liquid contact surface; the atomizing feed liquid spouted from the nozzle touching down on the liquid contact surface in the form of a thin liquid film and undergoing further reductions in thickness under the influence of the centrifugal force resulting from the rotation of the atomizing head before being atomized into fine particles at the peripheral edge portions thereof. If desired, there may be provided a plural number of spout nozzles directed toward the rotary atomizing head instead of a single nozzle, for spouting the same kind of liquid simultaneously from a number of nozzles or for spouting different kinds of liquids from the respective nozzles.

This invention relates to a rotary liquid sprayer which is useful in paint coating, spray-drying, spray-granulation and preparation of emulsions, slurries or the like, and more particularly to a rotary liquid sprayer which is adapted to spout an atomizing liquid

onto a rotary atomizing head and to spray the liquid therefrom in an atomized state.

In general, spraying devices with a rotary atomizing head in the form of a rotary disc or the like are widely applied in the fields of paint coating and spray-granulation, supplying a feed liquid to the rotary atomizing head which is put in high speed rotation thereby to spray the liquid in an atomized state.

In order to obtain finely divided particles of high quality and of narrow particle size distribution in the atomization of a liquid by the rotary atomizer type sprayer, it is necessary to form the feed liquid into a uniform filmy stream of as small a thickness as possible, on a liquid contact surface provided on the rotary atomizing head. However, in the prior art devices mentioned above, the atomizing liquid which is fed to the rotary atomizing head through a liquid feed tube is dropped or poured onto the liquid contact surface in the form of a columnar stream of low velocity, so that the liquid on the liquid contact surface at high speed rotation is caused to flow linearly in a radially outward direction under the influence of the centrifugal force without forming a thin filmy stream, resulting in extremely low uniformity at the edge of the rotary atomizing head. Consequently, it is often found difficult to atomize the feed liquid into finely divided particles of narrow particle size distribution.

With the foregoing situations in view, the present invention has as its object the provision of a rotary sprayer which is capable of good quality atomization.

It is a more particular object of the present invention to provide a rotary sprayer which is capable of atomizing a feed liquid into extremely fine particles

of good quality and narrow particle size distribution.

It is another object of the present invention to provide a rotary sprayer which is capable of forming a feed liquid into a film of uniform and extremely small thickness and spreading the thin filmy stream of the liquid uniformly over the entire area of a liquid contact surface of a rotary atomizing head.

In order to achieve the above-mentioned objectives, the present invention provides a rotary sprayer which is characterized by the provision of: a rotary atomizing head provided with a liquid contact surface for receiving an atomizing liquid; a rotational shaft for rotating the rotary atomizing head at a high speed; and at least one spout nozzle adapted to spout the atomizing liquid toward the liquid contact surface in a diverging pattern of a predetermined shape in plan view by application of pressure.

If desired, a plural number of similar spout nozzles may be provided on the sprayer, spouting a liquid of one kind from the nozzles or spouting a number of different kinds of liquids separately from the respective nozzles.

Typical examples of the atomizing liquid include paints, and fat and oil or resin to be used as a stock of granulation liquid. In a case where the rotary sprayer is used for the production of an emulsion or a slurry liquid, the atomizing liquid consists of a continuous phase liquid and a disperse phase liquid. Examples of the paint include, in addition to ordinary paints, the two-component type paints which consist of a mixture of a base material and a hardener or the three-component type paints which consist of a base material, a hardener and a catalyzer. These sorts of paints may be mixed prior to supply to the spout nozzle, but the respective components of the paint may be

spouted separately through a corresponding number of nozzles to mix them on the liquid contact surface of the rotary atomizing head, if desired. Especially in the case of these types paints with short pot life which harden soon when kept in a mixed state, it is preferred to mix the respective components on the liquid contact surface of the atomizing head. On the other hand, in the case of a liquid which is solidified or highly viscous at room temperature, e.g., the stock liquid for granulation or the liquid to be used as a disperse phase liquid of an emulsion or a slurry, the liquid is spouted from the nozzle after liquefying or lowering the viscosity by heating. In such a case, the liquid contact surface of the rotary atomizing head is heated or maintained at a suitable temperature by a supply of heated steam or air, thereby preventing increases in viscosity or solidification of the feed liquid on the liquid contact surface of the atomizing head.

Further, although the feed liquid is atomized by the mechanical atomizing action of the centrifugal force resulting from the rotation of the rotary atomizing head, a high voltage is applied to the rotary atomizing head depending upon the physical properties of the feed liquid thereby to accelerate the atomization by the electrostatic atomizing action in addition to the mechanical atomizing action.

The above and other objects, features and advantages of the present invention will become apparent from the following description and the appended claims, taken in conjunction with the accompanying drawings which show by way of example some illustrative embodiments of the invention.

In the accompanying drawings:

Figure 1 is a schematic sectional view of a rotary sprayer which constitutes the first embodiment of

the present invention;

Figure 2 is a schematic front view of a spout nozzle;

Figures 3(a) to 3(c) are schematic views explanatory of the patterns of the feed liquid which is spouted by the nozzle onto the liquid contact surface of the rotary atomizing head;

Figure 4 is a schematic view of the rotary sprayer of the invention as applied to a paint coating machine;

Figure 5 is a schematic view of the rotary sprayer of the invention as applied to a spray-granulating machine;

Figure 6 is a schematic sectional view of a rotary sprayer which constitutes a second embodiment of the present invention;

Figures 7(a) to 7(f) are schematic views explanatory of the patterns of the feed liquid which is spouted by the nozzles onto the liquid contact surface of the rotary atomizing head;

Figure 8 is a schematic sectional view of a rotary sprayer which constitutes the third embodiment of the present invention;

Figure 9 is a bottom view of the rotary sprayer of Figure 8;

Figure 10 is a schematic view of the rotary sprayer of Figure 8 as applied to an emulsifier;

Figure 11 is a schematic sectional view of a rotary atomizing head in a rotary sprayer which constitutes the fourth embodiment of the present invention;

Figure 12 is a bottom view of the rotary atomizing head of Figure 11; and

Figure 13 is a schematic sectional view of a rotary atomizing head in a rotary sprayer which

constitutes the fifth embodiment of the present invention.

Referring to the drawings and first to Figures 1 to 3, there is shown the first embodiment of the present invention, wherein indicated at 1 is a rotary atomizing head of disc- or plate-like shape which is securely mounted on a rotational shaft 3 of a motor 2 such as an electric motor or an air motor. The rotary atomizing head 1 is rotationally driven from the motor 2, for example, at a speed of 1,500 to 60,000 r.p.m. For high speed rotation of the rotary atomizing head 1, it is preferred to employ an air motor, especially a turbo air motor. Formed on the upper surface of the rotary atomizing head 1 is a liquid contact surface 4 which receives the supply of the atomizing liquid. In the peripheral portion of the liquid contact surface 4, there are provided a multiplicity of grooves 1B which are V- or U-shape in section and extend toward the edge portion 1A of the rotary atomizing head 1. The grooves 1B can be dispensed within some cases depending upon the physical properties of the atomizing feed liquid.

A liquid feed tube 5 which directs the atomizing liquid toward the liquid contact surface 4 is securely mounted on the casing of the motor 2. A spout nozzle 6 is attached to the distal end of the liquid feed tube 5 and discharges toward a position in the vicinity of the rotational center of the liquid contact surface 4. The rear end of the liquid feed tube 5 is connected to the end of a liquid feed hose 7 which is also supported on the casing of the motor 2. The other end of the liquid feed hose 7 is connected to a liquid tank or reservoir 9 through a pump 8 which delivers the feed liquid under pressure. The liquid tank 9 serves as a reservoir for a paint when the sprayer is used for paint coating, and as a reservoir for the stock of fat

and oil or a resin in the case of a spray-granulator. The atomizing liquid which is delivered under pressure from the pump 8 is spouted toward the liquid contact surface 4 through the spout nozzle 6 which is, as particularly shown in Figure 2, provided with a liquid spout hole 6A, a spherical projection 6B which surrounds the spout hole 6A, and a V-shaped guide groove 6C which is cut across the spherical projection 6B to form lips on opposite sides of the spout hole 6A. With this nozzle construction, the liquid which is spouted under pressure from the spout hole 6A is formed into a spreading pattern and directed toward the liquid contact surface 4 substantially in an elliptic shape in plan view as shown in Figure 3(a). Therefore, if a liquid with a viscosity of 30 c.p. is spurted from the spout nozzle 6 which is placed at a distance of 10 mm from the liquid contact surface 4 under sufficient liquid pressure to deliver 100 cc/min to 300 cc/min, for example, the liquid spout hole 6A of the nozzle is preferred to have an equivalent orifice diameter of about 0.3 mm to 0.7 mm to obtain a spouted pattern of about 13 mm to 20 mm in length of its major axis. The shape of the liquid spout pattern is determined by the shape of the guide groove 6C. If the guide groove 6C is formed in a conical shape, the feed liquid is spouted in a circular shape in plan view as shown in Figure 3(b) or in an arcuate shape as shown in Figure 3(c). It is to be noted that the liquid spout pattern may be of any arbitrary shape in plan view as long as the liquid is spread toward the liquid contact surface 4 of the rotary atomizing head 1.

In order to atomize and spray the feed liquid by the rotary sprayer of the above-described construction, firstly the rotational shaft 3 is driven from the motor 2 to rotate at high speed the rotary

atomizing head 1 which is mounted on the rotational shaft 3, and then the pump 8 is actuated to deliver the atomizing liquid to the spout nozzle 6 under a predetermined pressure to spurt the liquid toward the liquid contact surface 4 from the spout hole 6A of the nozzle 6. In this manner, the feed liquid which is spouted in a pattern of an elliptic shape in plan view and spreading in a sectoral shape by the provision of the guide groove 6C, and the spread liquid film undergoes reductions in thickness to a certain extent before reaching the liquid contact surface 4. Since the liquid is spouted from the nozzle 6 under a predetermined pressure, the spurted liquid intimately covers the liquid contact surface 4 in the form of a thin film. In this instance, the liquid spout nozzle 6 is preferred to be oriented toward a position as close as possible to the rotational center of the liquid contact surface 4 where the linear velocity is smaller. By so doing, the liquid film can be adhered to the liquid contact surface 4 more intimately. The spacing distance between the spout nozzle 6 and the liquid contact surface 4 should be in a range in which the spurted liquid can reach the liquid contact surface while it still retains the form of a thin film without undergoing atomization. This is because the spouted liquid is scattered if it is atomized before reaching the liquid contact surface 4.

The thin film of the feed liquid which is adhered on the liquid contact surface in the above-described manner is caused to spread toward the circumference of the liquid contact surface 4 under the influence of the centrifugal force, and further undergoes uniform reductions in thickness before reaching the edge portion 1A of the atomizing head 1. The atomizing liquid which has been formed into a film

of an extremely small thickness is divided by the grooves 1B in the edge portion 1A to form very fine cusps of high uniformity in diameter around the circumference of the atomizing head 1. The cusps thus formed are atomized into fine and uniform particles by the mechanical atomizing action of the centrifugal force. Although the grooves 1B are extremely convenient for the formation of cusps, it is possible to form cusps of good condition without using the grooves 1B depending upon the physical properties of the feed liquid.

Now, reference is made to Figure 4 which shows the above-described rotary sprayer of the invention as applied to a paint applicator. As illustrated in the figure, the rotary sprayer 10 is located in a coating booth with a conveyer 11 which is looped in ⎍ shape, so that a paint is sprayed on a workpiece 12 from the rotary sprayer 10 while the former is transferred by the conveyer 11. In this instance, in order to use the rotary sprayer as a paint applicator, a high voltage of a predetermined potential is applied to the rotary atomizing head 1 relative to the workpiece 12 which is maintained at the earth potential, thereby to form an electrostatic field between the rotary atomizing head 1 and the workpiece 12. By the action of the electrostatic field, the charged particles of the paint which is sprayed from the rotary atomizing head 1 are propelled toward and adhered on the workpiece 12, permitting to perform the coating operation in an efficient manner. For this purpose, for instance, the rotary atomizing head 1 is electrically connected to a high voltage power supply 14 through a high voltage cable 13 as shown in Figure 4. The high voltage power supply 14 is adapted to increase the commercial power to, for example, -30 to -120 KV and to apply same to the rotary atomizing head 1 through the high voltage cable

13. The rotary sprayer 10 may be vertically moved supported on a lift cylinder 15 and secured to the piston rod of the cylinder 15 through an insulating bracket 16 which is connected to the high voltage cable 13.

In operation, the paint is fed under pressure to the spout nozzle 6 by operation of the pump 8, while the rotary atomizing head 1 is rotated at a high speed by the motor 2 and simultaneously supplied with a high voltage by operation of the high voltage power supply 14. As the rotary sprayer 10 is operated in this manner, the fine particles of the paint which are atomized by the rotary atomizing head 1 are effectively applied to the workpiece 12 by the action of the electrostatic field formed between the rotary atomizing head 1 and the workpiece 12.

As described hereinbefore, the feed liquid which is a paint in this particular embodiment can be atomized into fine particles of narrow particle size distribution by the operation of the rotary sprayer 10, so that it is possible to form a uniform coating film of the paint on the workpiece 12 and therefore to improve the quality of the coating to a marked degree.

Referring to Figure 5, there is schematically illustrated an example of a spray-granulator incorporating the rotary sprayer according to the present invention, in which the rotary atomizing head 1 of the rotary sprayer 10 is disposed in a drying tower 21 of the granulator. A drying air feed pipe or duct 22 which is opened at one end into the drying tower 21 is connected at the other end to an air blower 23 through an air heater or furnace 24 which heats up the air from the blower 23. The lower end of the drying tower 21 is connected to a granule collector 25 for receiving the granulated fine particles. The granule

collector 25 is connected to an exhaust gas pipe 26 and provided with a discharge port 25A at the lower end thereof. Depending upon the specific gravity and grain size of the granulated fine particles, there may be employed other types of collectors such as a cyclone, bag filter or the like.

The stock liquid to be atomized, which is stored in the tank 9, is fed under pressure to the spout nozzle 6 by the pump 8 and sprayed from the rotary atomizing head 1 in the same manner as described hereinbefore.

In this instance, the fine particles of the liquid which is sprayed from the rotary atomizing head 1 are dried in the drying tower 21 by contact with the hot air which is fed through the drying air feed pipe 22 and dropped into the granule collector 25. The granulated fine particles thus produced are taken out through the discharge port 25A at the lower end of the granule collector 25.

Figure 6 illustrates the second embodiment of the invention, which employs a couple of spout nozzles. More specifically, the sprayer is provided with a rotary atomizing head 101 of disc- or plate-like shape which is securely mounted on a rotational shaft or spindle 103 similarly to the first embodiment. The rotary atomizing head 101 is also provided, though it is not compulsory, with a liquid contact surface 104 with a multitude of grooves 101A in its peripheral portions, each directed toward the edge portion 101A of the rotary atomizing head 101.

Vertically mounted on the casing of a motor 102 are a couple of atomizing liquid feed tubes 105 and 106 which have spout nozzles 107 and 108 attached to their respective fore ends. The positions of the liquid spout nozzles 107 and 108 are suitably determined

according to the flow rates of the liquid through the respective nozzles. In a case where a liquid is spouted at a large flow rate through the nozzle 107 and at a small flow rate through the nozzle 108, it is preferred to locate the nozzle 107 of large flow rate in a position spaced from the center of rotation of the liquid contact surface 104 and to locate the nozzle 108 of small flow rate in a position close to the rotational center. The base ends of the tubes 105 and 106 are connected to liquid feed hoses 109 and 110 which are in turn connected to the storage tanks or reservoirs 113 and 114 through pumps 111 and 112, respectively.

The rotary sprayer of the above-described construction can be used as a paint applicator or spray-granulator in the same manner as the first embodiment. The spout nozzles 107 and 108 may be used for spurting a liquid of the same kind or for spurting simultaneously two different kinds of liquids.

For example, there arises the necessity for spouting two different kinds of components in the case of the reaction hardening type paint applicator. Reaction hardening type paints are usually obtained by mixing a base material such as an unsaturated polyester-base paint or a polyurethane-base paint with a hardener. These sorts of paints with small solvent content have an advantage that it can be dried at room temperature or at a low temperature below 100°C, coupled with other excellent properties. However, the reaction hardening type paints involve inherent problems in handling. For example, they normally have a short pot life, so that they undergo reaction hardening in a relatively short time period and the spray-coating becomes difficult when the base material and the hardener are left in mixed state. Besides, it is necessary to spray the paint with the base material and

hardener in uniformly mixed state since otherwise the paint would form irregularly hardened spots on the surface of the workpiece, causing degradation in the quality of the coating.

Nevertheless, the present embodiment of the invention can be suitably applied as a reaction hardening type paint applicator. Now, the spray coating of the reaction hardening type paint is explained by way of a paint applicator for two-component reaction hardening type polyurethane paint which is obtained by mixing a base material and a hardener on the liquid contact surface 104 at a ratio of, for example, 3:1 - 10:1 by weight. In this case, the tank 113 stores polyol, the base material, while the tank 114 stores polyisocyanate which serves as a hardener. In this instance, the paint applicator may be generally arranged, for example, in the manner as shown in Figure 4.

In operation, the rotary atomizing head 101 is rotated at high speed by the motor 102 and at the same time the base material and the hardener in the tanks 113 and 114 are fed respectively to the nozzles 107 and 108 under predetermined pressures by the pumps 111 and 112. In this particular instance, the mixing ratio of the base material and the hardener is 3:1 - 10:1, so that the base material is delivered under a higher pressure than the hardener. Consequently, the spout nozzle 107 for the base material is opened toward a position on the liquid contact surface 104 which is spaced away from its rotational center, namely, toward a position where the linear velocity is relatively large. On the other hand, the spout nozzle 108 for the hardener is opened toward a position on the liquid contact surface 104 which is close to its rotational center, namely, to a position of small linear velocity. The hardener which is fed under

pressure to the spout nozzle 108 by the pump 112 is spurted from the nozzle 108 in an elliptic shape as shown at A_1 in Figure 7(a) and its thickness is reduced to some extent to form a thin filmy form before adhering on the liquid contact surface 104. The liquid film of the hardener which has adhered on the liquid contact surface 104 undergoes further reductions in thickness while it is spread toward the peripheral edge portions under the influence of the centrifugal force. On the other hand, the base material is spurted from the nozzle 107 in a pattern which is also of an elliptic shape in plan view as shown at A_2 in Figure 7(a) and spread onto the liquid contact surface 104 in a thin filmy form and mixed into the liquid film of the hardener. In this instance, as the base material is spurted under a predetermined liquid pressure, it readily mixes into the liquid film of the hardener to form a reaction hardening type paint consisting of a uniform mixture of the base material and the hardener. The paint thus formed is further reduced in film thickness as it is spread toward the edge portion 101A and sprayed therefrom in the form of fine and uniform particles. Thus, the base material and hardener are not mixed until they reach the liquid contact surface 104 and are uniformly mixed with each other on the liquid contact surface 104, so that it is possible to effect the spray coating even if the reaction hardening type paint is of a short pot life and to harden and dry the paint uniformly over the entire coated surface free of the trouble of irregular coated spots.

The positions of the spout nozzles 107 and 108 may be determined according to the flow rates of the liquid to be spurted therefrom. For example, in a case where equivalent amounts of liquid are spouted from the two nozzles, they are located in positions which are

substantially equidistant from the liquid contact surface 104 as shown in Figure 7(b). The nozzles 107 and 108 are not necessarily required to be located on the opposite sides of the rotational shaft 103, and may be located in positions on the same side as shown in Figure 7(c) or in angularly shifted positions as shown in Figure 7(d). Further, there may be provided a couple of spout nozzle for each one of the base material and hardener as shown particularly in Figure 7(e). When using a three component type reaction hardening paint which needs to mix a catalyzer in addition to the base material and hardener, the spout nozzles may be provided separately for the respective components as shown in Figure 7(f). These nozzles may be arranged to spurt the liquid substantially in a circular or arcuate or other suitable shape in plan view as explained in connection with Figure 3.

Although it is preferred to spurt different kinds of liquids from the spout nozzles 107 and 108 as mentioned hereinbefore, of course a liquid of the same kind may be spurted from these nozzles if desired. By spouting the same kind of liquid through a plural number of nozzles, it becomes possible to increase the quantity per unit time of the atomized particles while maintaining a good condition of atomization.

Referring now to Figures 8 and 9, there is shown the third embodiment of the present invention in which the rotary sprayer employs a bell-shaped rotary atomizing head. More specifically, in this case a hub member 203 is securely mounted on a rotational shaft 202 of a motor 201. The hub member 203 is formed with a first liquid contact surface 204 on the upper side thereof, opposingly to spout nozzles 207 and 208 which are attached to the fore ends of liquid feed tubes 205 and 206. A bell-shaped atomizing head body 210 is also

securely mounted on the hub member 203 in concentrical relation therewith, for example, through four support pins 209 as shown in Figure 9, to form the rotary atomizing head together with the hub member 203. The gap space between the hub member 203 and the atomizing head body 210 is divided into four slits 211 by the support pins 209. The atomizing head body 210 is provided with a second liquid contact surface 212 on its inner periphery, the second liquid contact surface 212 extending from the respective slits 212 to the lower marginal edge portion 210A of the atomizing head body 210 which is provided with a multiplicity of grooves 210B.

With the foregoing construction, the feed liquid is also spouted in a flat shape in plan view onto the first liquid contact surface 204 from the respective nozzles 207 and 208. The film of the feed liquid which has been adhered onto the first liquid contact surface 204 is guided onto the second liquid contact surface 212 through the slits 211 and sprayed from the grooved edge portion 210A.

The above-described rotary sprayer which is useful as a paint sprayer and a spray-granulator can also serve as means for producing an emulsion or a slurry by employing the arrangement as exemplified in Figure 10. In this figure, the rotary sprayer 220 may be vertically movable supported on a cylinder 222 through an insulating bracket 221 and received in a basin 223. Liquid feed tubes 205 and 206 with a spout nozzles at the fore ends thereof are connected to a continuous phase liquid feed hose 224 and a disperse phase liquid feed hose 225, respectively. The other ends of the respective liquid feed hoses 224 and 225 are connected to a continuous phase liquid reservoir 228 and a disperse phase liquid reservoir 229 through pumps 226

and 227, respectively. Upon driving the pumps 226 and 227, the continuous and disperse phase liquids are supplied to and uniformly mixed in the rotary sprayer 220 and sprayed into the basin 223. In order to accelerate the atomization and to prevent the atomized particles from whirling up out of the basin 223, there may be provided a high voltage power supply 230 thereby to apply a high voltage to the atomizing head body 210 of the rotary sprayer 220 through a high voltage cable 231.

Opened into the bottom of the basin 223 are discharge pipes 232 which are connected to a collecting vessel 234 through an on-off valve 233. With this arrangement, the emulsion or slurry which is produced in the basin 223 by the above-described spraying operation of the rotary sprayer 220 is collected into the collecting vessel 234 through the pipes 232 upon opening the on-off valve 233.

In this instance, if the disperse phase liquid is of the nature which is highly viscous or in solidified state at room temperature, a heating vessel is employed for the disperse phase liquid reservoir 229 to lower the viscosity of the disperse phase liquid to be supplied to the rotary sprayer 220. In this connection, it is taken into consideration that the air convection generally referred to as an air pumping phenomenon occurs on the inner surface of the atomizing head body 210 of the rotary sprayer 220 which is rotated at a high speed, as a result cooling and increasing the viscosity of the disperse phase liquid. In order to prevent such cooling of the disperse phase liquid, there is provided a heat source 235 in communication with one end of a pipe 236 the other end of which is led into the basin 223 and opened toward the inner surface of the atomizing head body 210. A heating medium such as hot

air or steam is sent from the heat source 235 toward the inner surface of the atomizing head body 210 through the pipe 236 thereby keeping the disperse phase liquid at a low viscosity and effecting the atomization in good condition for efficient production of the emulsion or slurry.

Figures 11 and 12 illustrate a further modification of the rotary atomizing head. The rotary atomizing head 301 which is employed here is also of a bell-shape similar to the above-described third embodiment but it is formed integrally with the hub member. A first liquid contact surface 302 which receives the supply of the atomizing liquid and a second liquid contact surface 303 on which the atomizing liquid is spread in a filmy form toward the edge portions 301A are connected with each other through a multiplicity of small holes 304.

With this arrangement, the atomizing liquid which has touched down on the liquid contact surface 302 is guided toward the small holes 304 in a uniform thickness in the circumferential direction, so that it is readily formed into a thin liquid film uniformly on the second liquid contact surface 303.

Further, the rotary atomizing head may be formed into the form of an inverted saucer as shown particularly in Figure 13, which is similarly provided with a first liquid contact surface 402, a second liquid contact surface 403 and narrow distributing holes 404.

Although the invention has been described in terms of specific embodiments, it is to be understood that other forms of the invention may be readily adopted within the scope of the invention as defined in the appended claims.

CLAIMS

1. A rotary liquid sprayer, comprising in combination:

a rotary atomizing head provided with a liquid contact surface for receiving an atomizing feed liquid thereon;

a rotational shaft for rotating said rotary atomizing head at a high speed; and

at least one liquid spout nozzle adapted to spout said feed liquid under pressure toward said liquid contact surface in a diverging pattern of a predetermined shape in plan view.

2. The rotary liquid sprayer as set forth in claim 1, wherein a plurality of said liquid spout nozzles is provided over said liquid contact surface of said rotary atomizing head for spouting the same kind of liquid through said nozzles.

3. The rotary liquid sprayer as set forth in claim 1, wherein a plurality of said liquid spout nozzles is provided over said liquid contact surface of said rotary atomizing head for simultaneously spouting different kinds of liquids through said nozzles.

4. The rotary liquid sprayer as set forth in claim 3, wherein, in use, a base material and a hardener of a reaction hardening type paint are separately spouted from said liquid spout nozzles.

5. The rotary liquid sprayer as set forth in claim 3, wherein, in use, a base material, a hardener and a catalyzer of a reaction hardening type paint are separately spouted from said liquid spout nozzles.

6. The rotary liquid sprayer as set forth in claim 3, wherein, in use, a continuous phase liquid and a disperse phase liquid are separately spouted from said liquid spout nozzles.

7. The rotary liquid sprayer as set forth in any one of claims 1 to 6, wherein said rotary atomizing head is a disc-shaped rotary atomizing head with said liquid contact surface formed on the upper side thereof.

8. The rotary liquid sprayer as set forth in any one of claims 1 to 6, wherein said rotary atomizing head is a bell type rotary atomizing head consisting of a hub member and a bell-shaped rotary atomizing body provided concentrically with said hub member, said hub member being provided with a first liquid contact surface on the upper side thereof and said atomizing head body being provided with a second liquid contact surface on the inner peripheral surface thereof.

9. The rotary liquid sprayer as set forth in any one of claims 1 to 8, wherein a multiplicity of grooves is provided in the peripheral edge portions of said liquid contact surface.

10. The rotary liquid sprayer as set forth in any one of claims 1 to 9, including means for applying a high voltage to said rotary atomizing head.

11. The rotary liquid sprayer as set forth in any one of claims 1 to 10, wherein, in use, a paint is spurted from said at least one liquid spout nozzle.

12. The rotary liquid sprayer as set forth in any one of claims 1 to 10, wherein, in use, a stock of a granulation liquid is spouted from said at least one liquid spout nozzle.

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Fig. 1

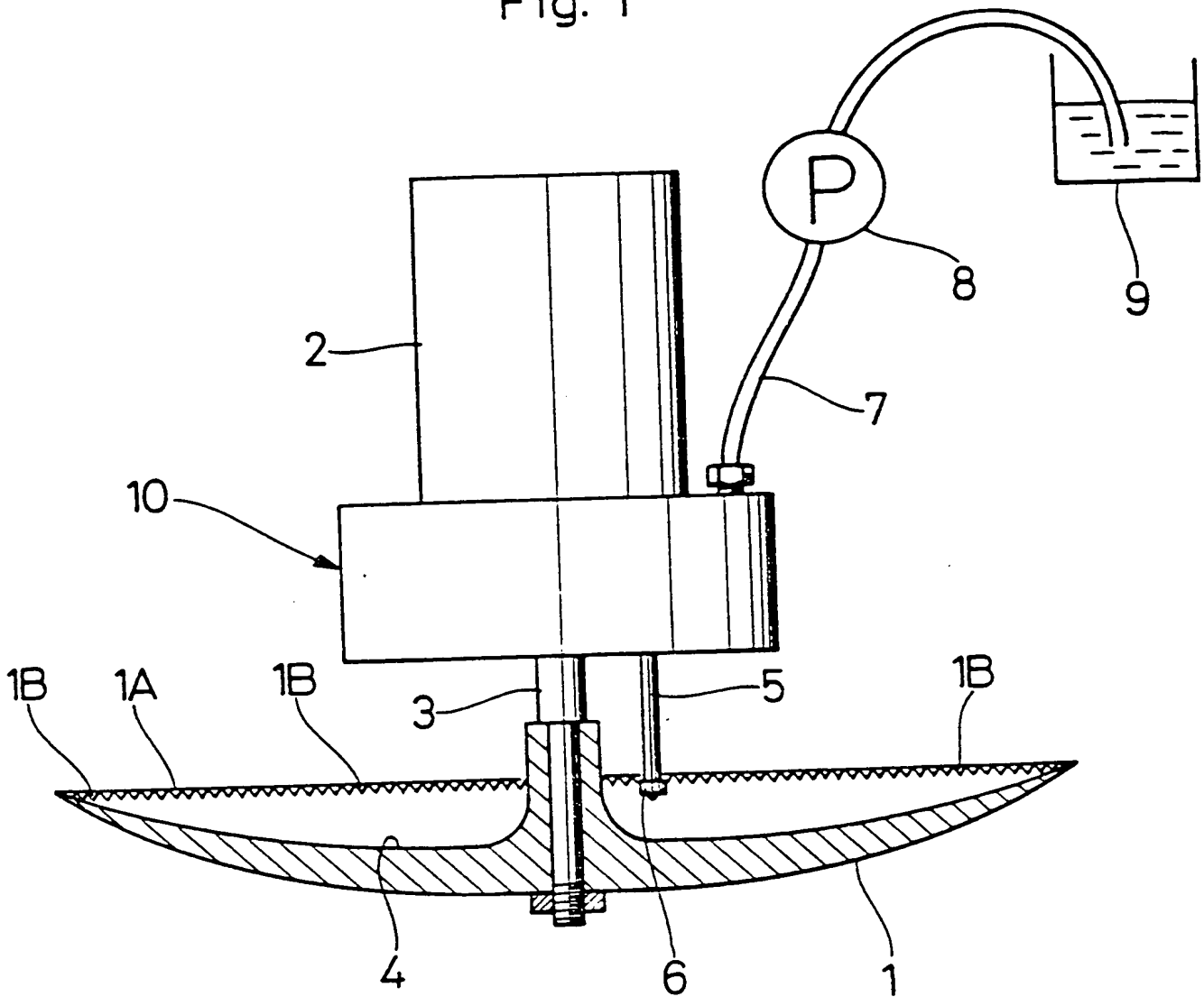


Fig. 2

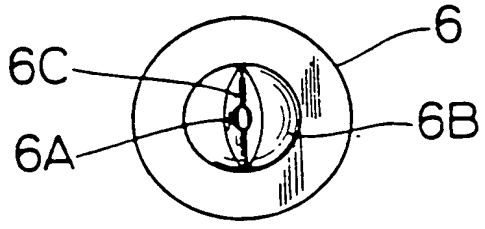
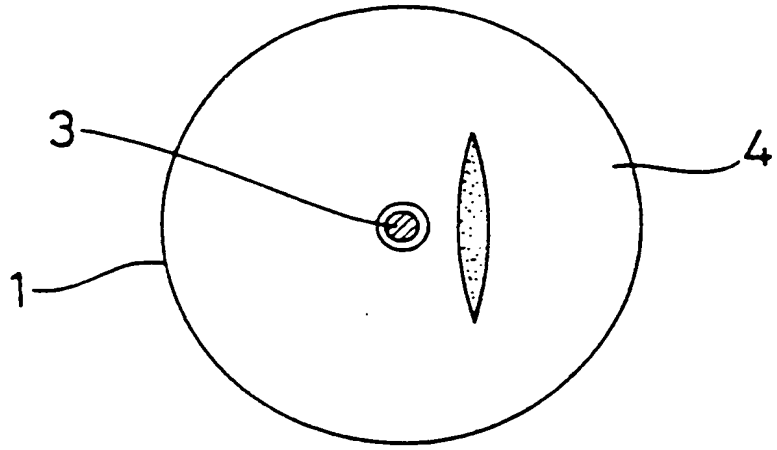
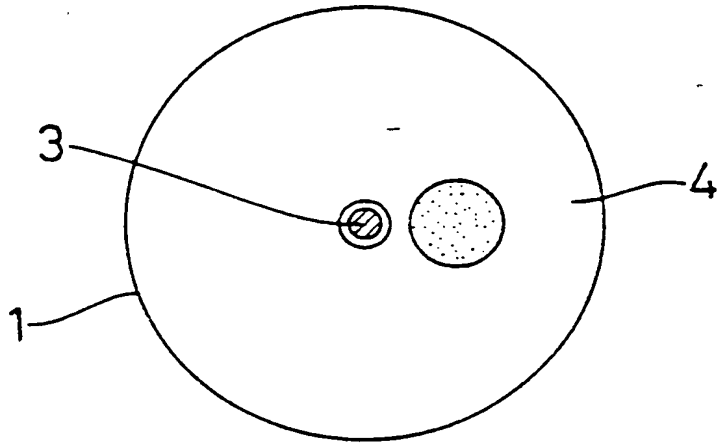


Fig. 3

(a)



(b)



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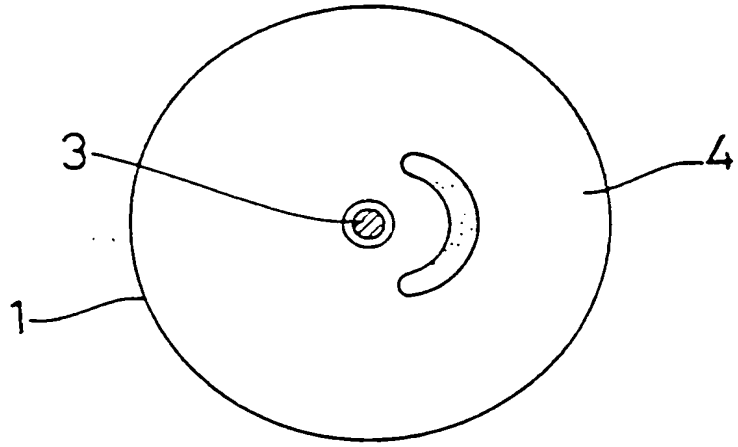


Fig. 4

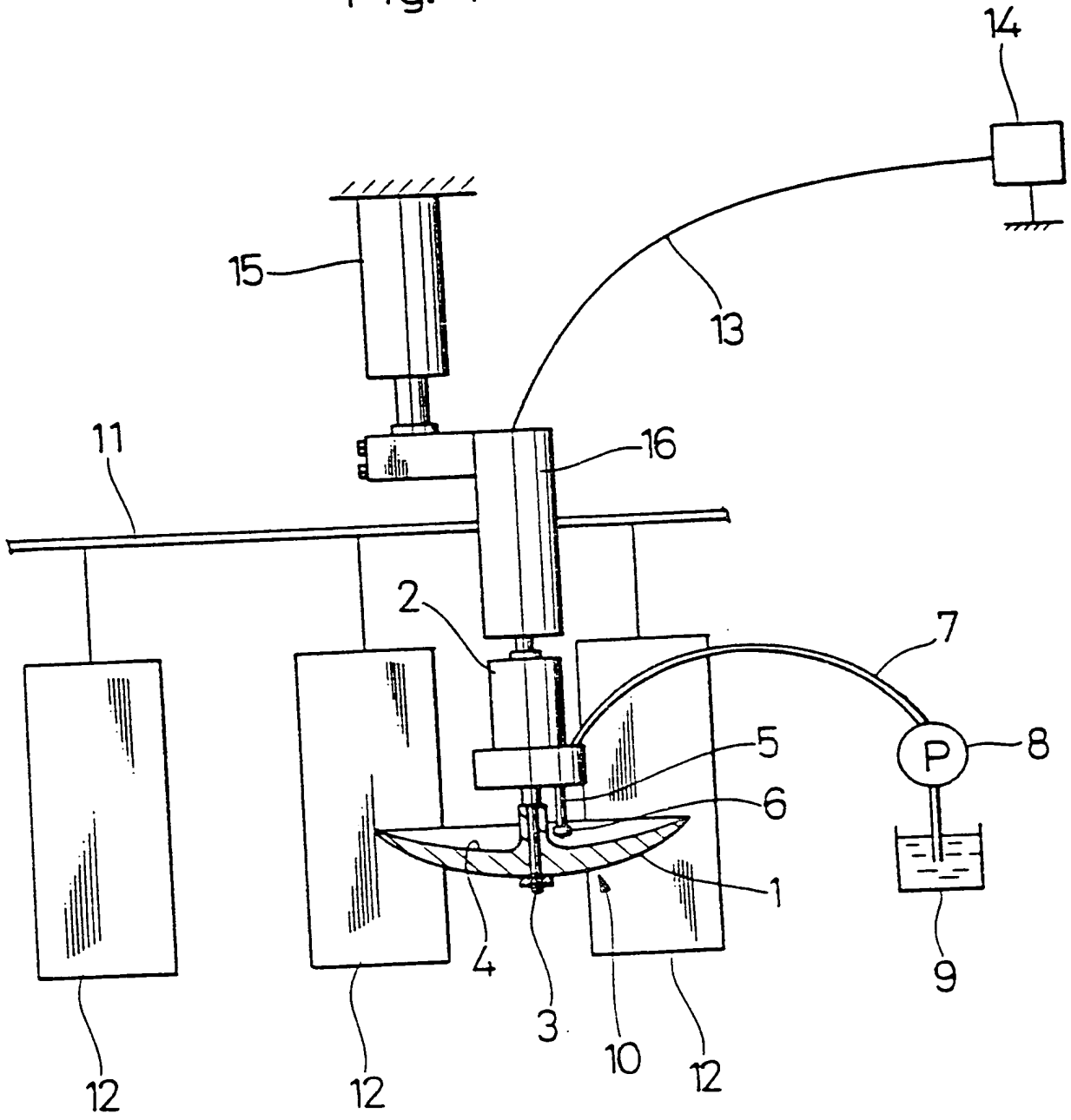
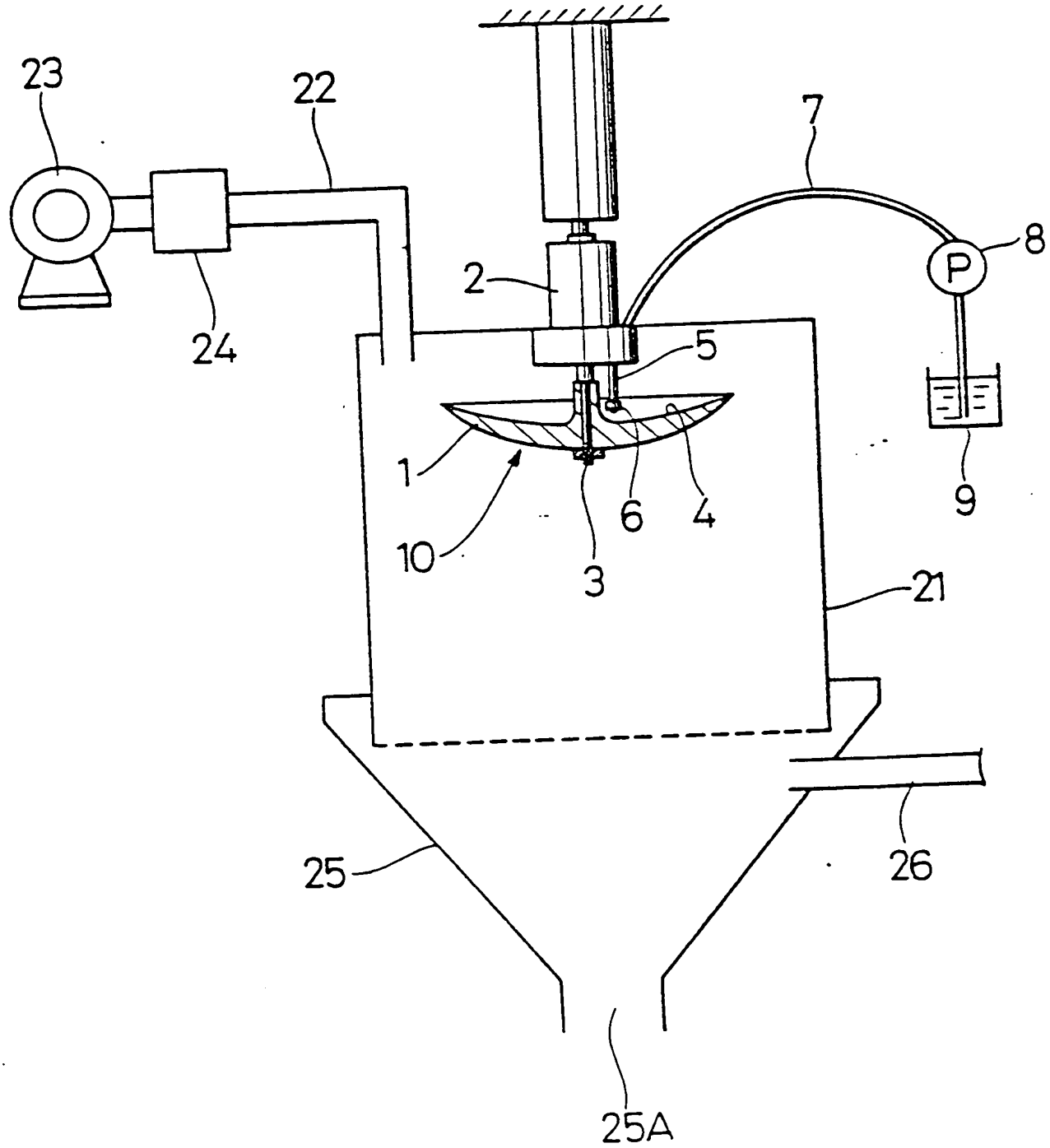


Fig. 5



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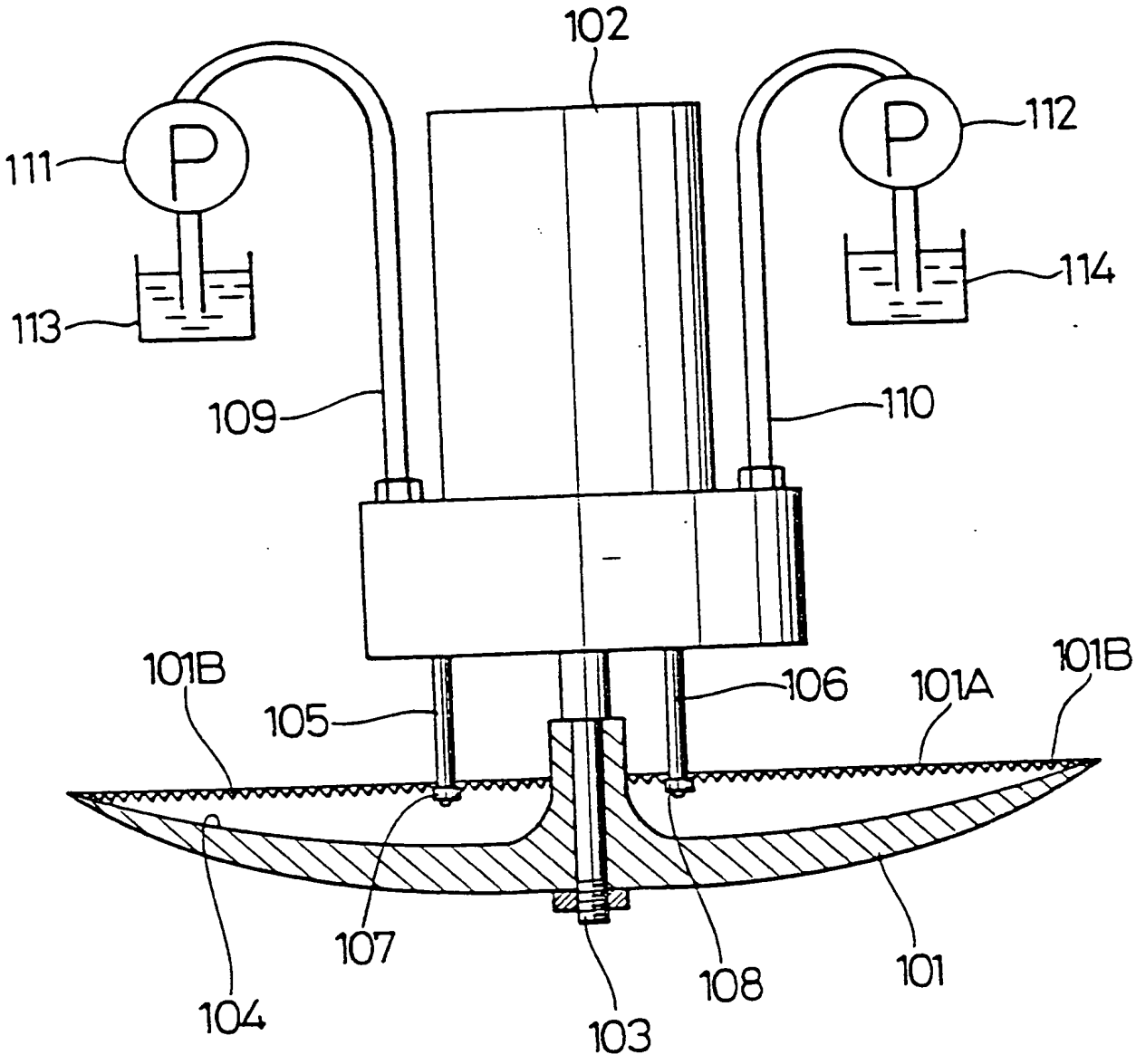
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Fig. 7

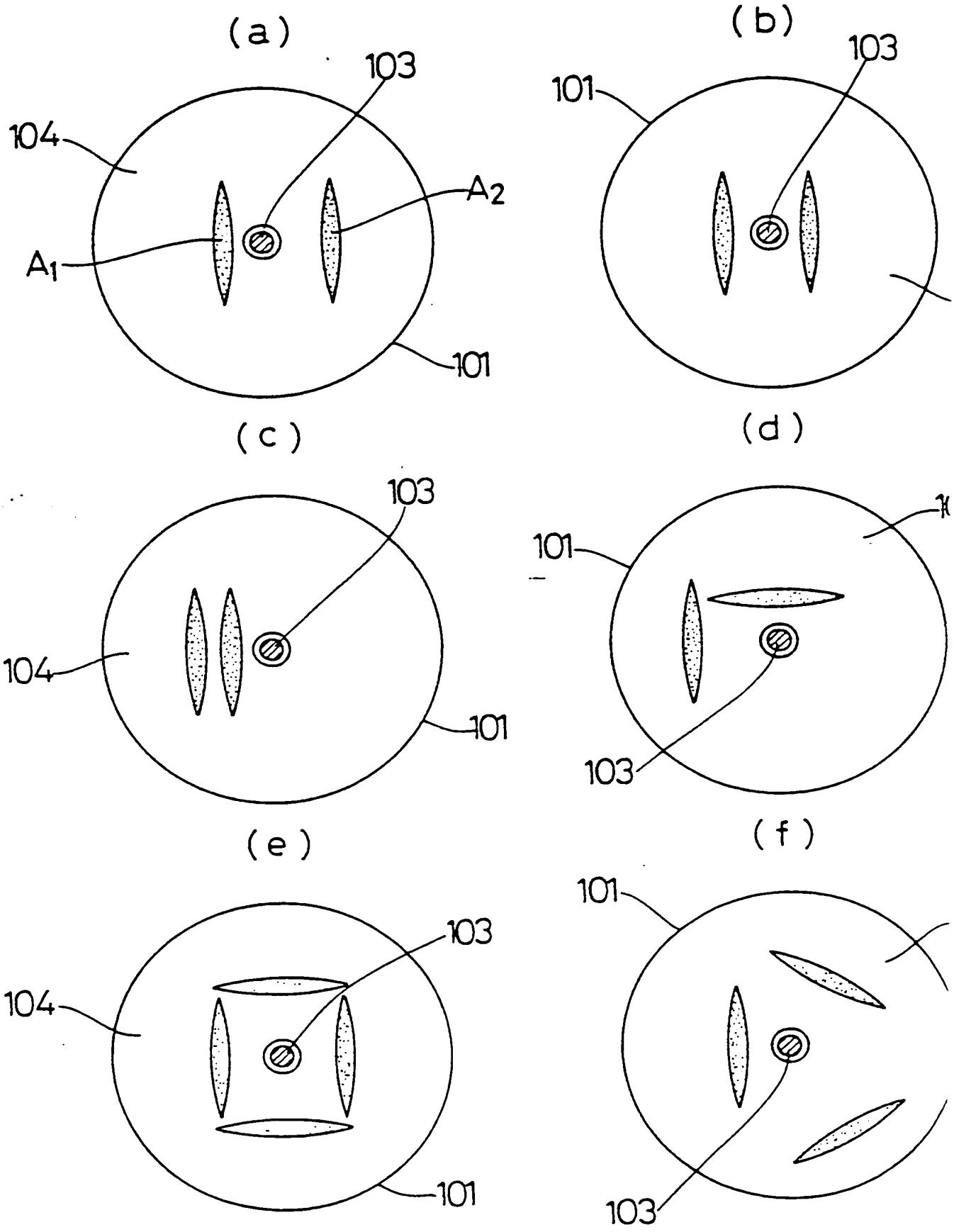
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Fig. 8

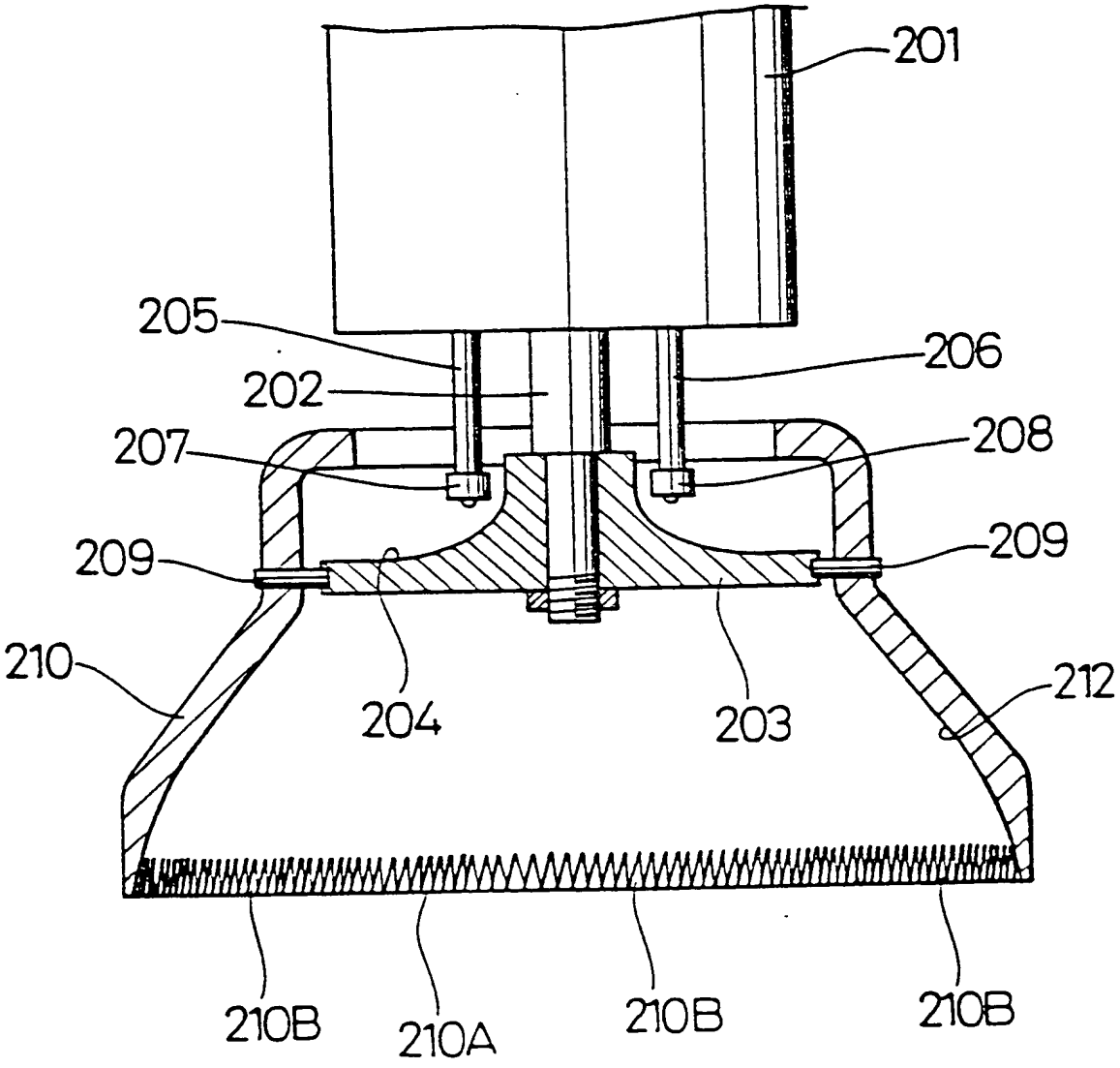
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Fig. 9

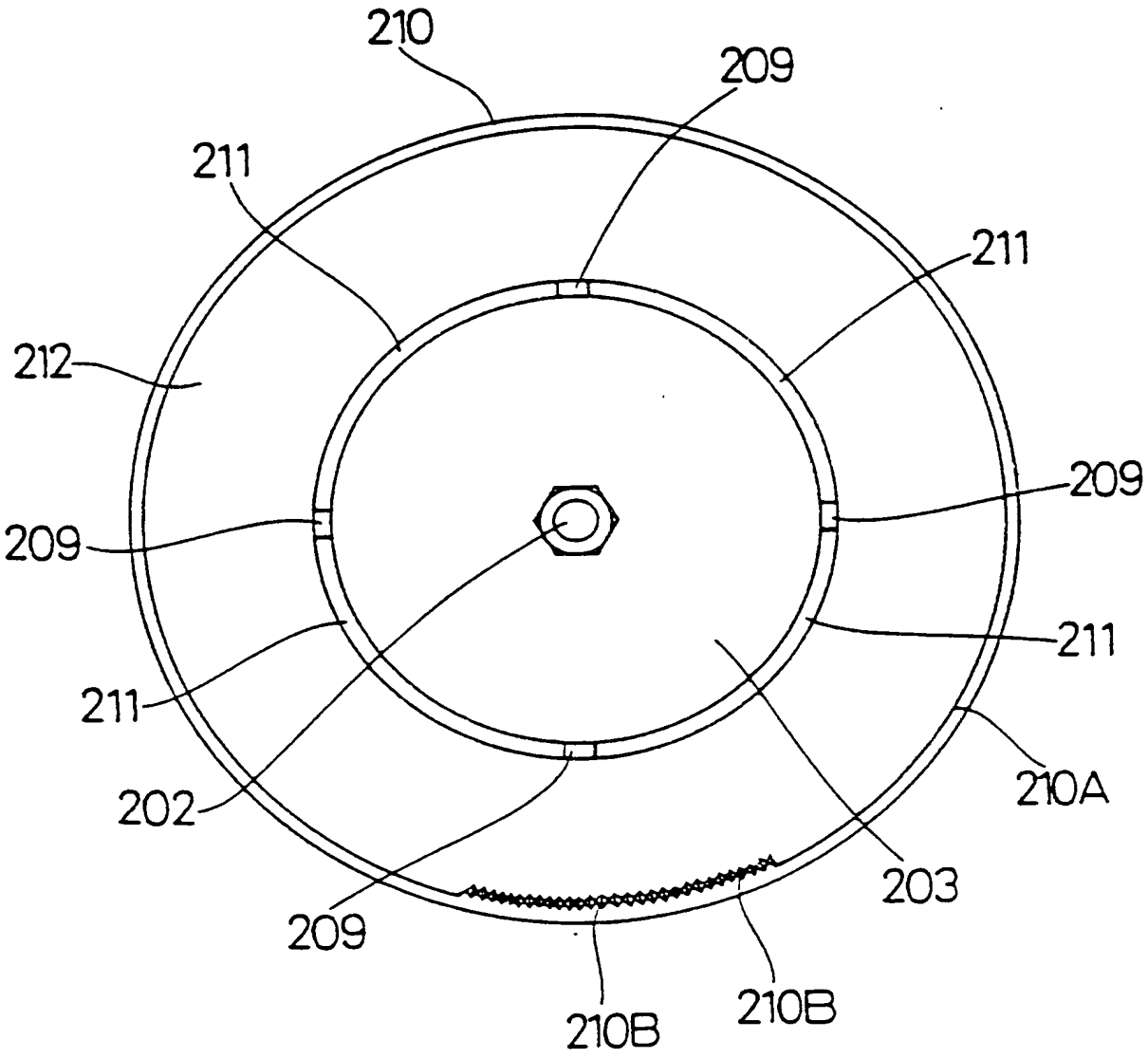

Fig. 10

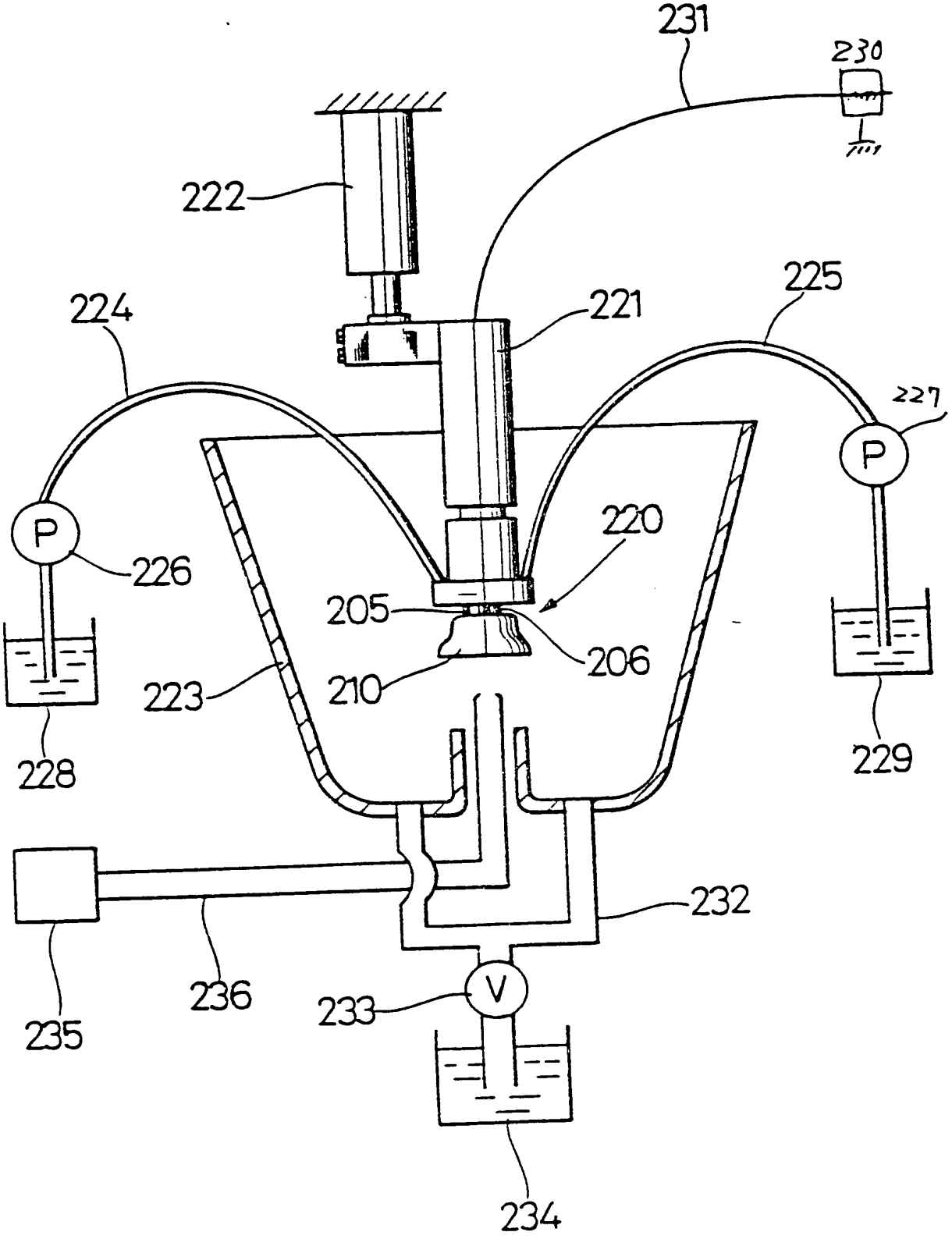
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Fig.11

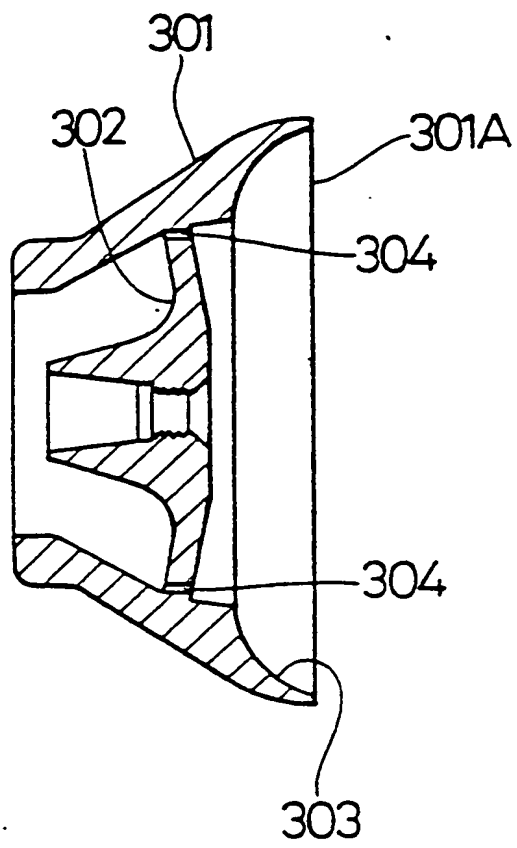


Fig.12

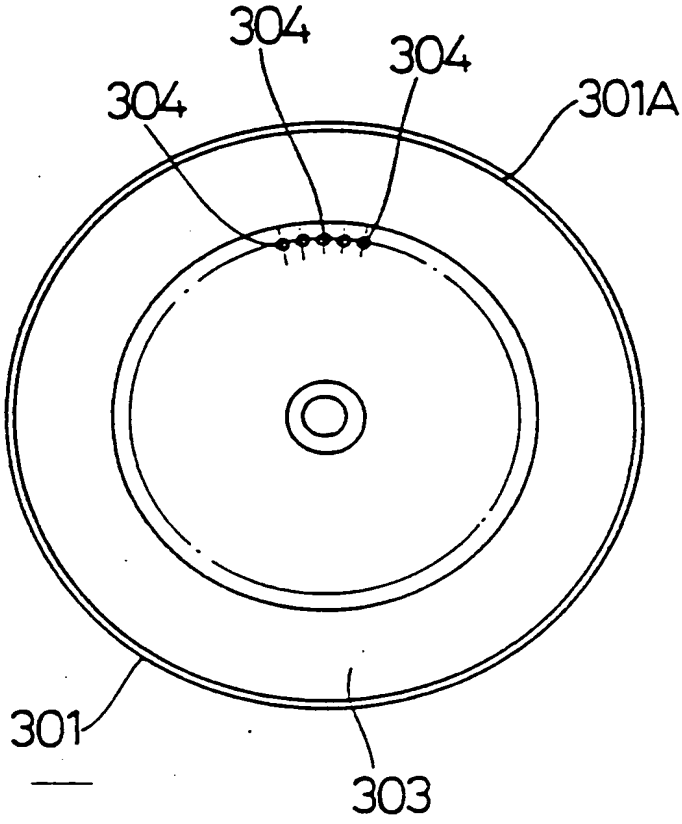
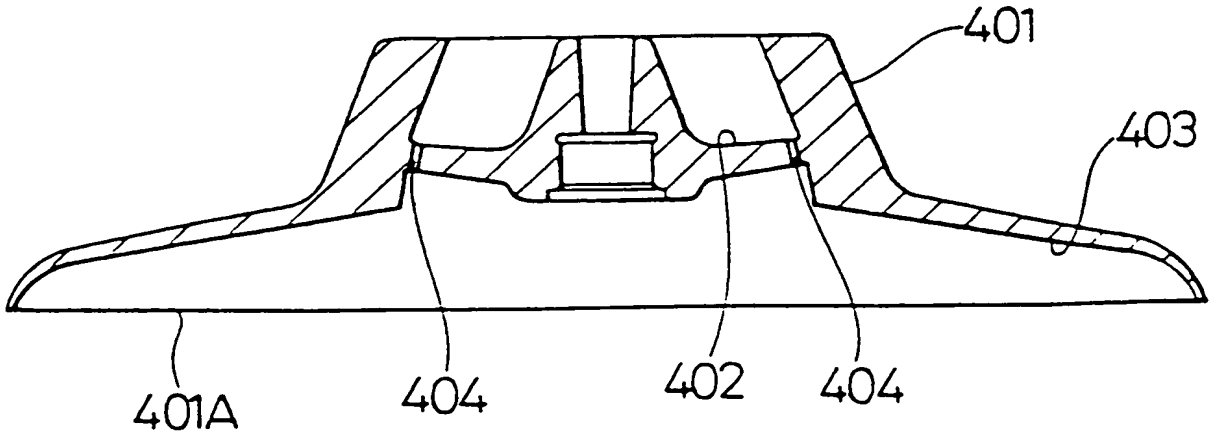


Fig.13



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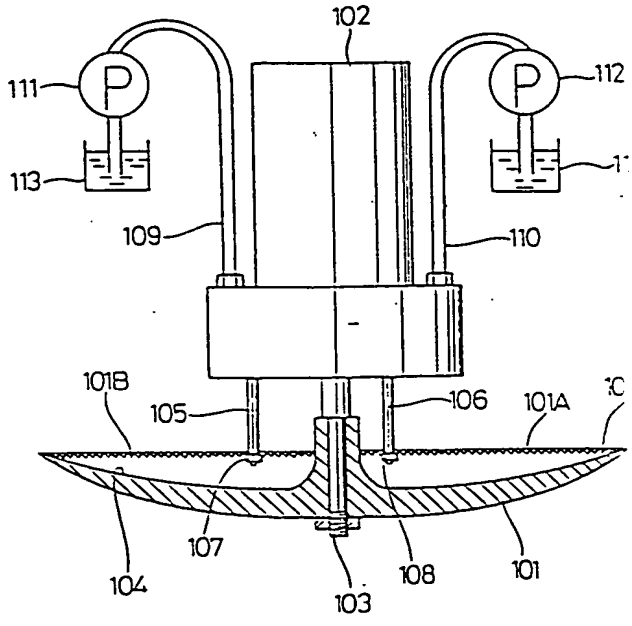
(54) Rotary liquid sprayer.

(57) A rotary liquid sprayer comprises a rotary atomizing head (101) provided with a liquid contact surface (104) onto which one or more liquids to be sprayed can be delivered from at least one liquid spout nozzle (107, 108), the liquid being discharged thereby in a diverging pattern of a predetermined shape in plan view. A high voltage may be applied to the rotary head (101) if desired.



EP 0 109 224 A3

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EUROPEAN SEARCH REPORT

Application number 0109224

EP 83 30 6628

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	FR-A-1 363 681 (OESTERLE) * Column 1, last line - page 2, column 2, line 33; figure 1 *	1,7,10,11	B 05 B 3/10 B 05 B 5/04
A	US-A-3 133 702 (STELCHEK) * Column 1, lines 15-18; figure 2 *	2-4,11	
A	US-A-3 281 076 (BURNSIDE et al.) * Column 4, lines 24-27; figure 1 *	2,3,8	
A	GB-A-2 008 439 (YOSHINORI TADA et al.) * Figure 2 *	9	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	GB-A- 314 484 (COLGATE-PALMOLIVE) * Page 1, lines 13-24 *	12	B 05 B B 01 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03-04-1985	JUGUET J.M.

CATEGORY OF CITED DOCUMENTS

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